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EXAMINER	
AFZALI, SARANG	

ART UNIT	PAPER NUMBER
3726	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/767,483	VAIDYANATHAN ET AL.	
	Examiner	Art Unit	
	Sarang Afzali	3726	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *Amendment filed 4/4/2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-14 and 27-32* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-14 and 27-32* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 January 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. The applicant's amendment filed on 4/4/2007 has been fully considered and made of record.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1, 27, 29, and 31 are rejected under 35 U.S.C. 102(b) as being anticipated by Butcher (US 4,814,029).

As applied to claim 1, Butcher teaches a method for forming channeled bodies comprising:

(a) simultaneously co-extruding a first composition (inner core C/organic cores 22, Figs. 2 & 5) and a second composition (surrounding material T/layer 24, Figs. 2 & 5) to form one or more two-component filaments (strands 20, Fig. 5), the one or more filaments including the first composition (22, Fig. 5) encased in the second composition (24, Fig. 5);

(b) mechanically processing the filaments (strands 20) to arrange them in a predetermined orientation to provide a green body by depositing the filaments onto a working surface in one or more layers (Fig. 6).

(c) subjecting the green body to conditions effective for removing the first composition (cores 22) from intermediate body and sintering the second composition (24, col. 5, lines 39-47) to provide a heat exchanger wherein channels having walls made of the sintered second composition for containing coolant flow with the channels having inner diameters of no more than about 2000 microns (col. 7, lines 6-10).

Note that Butcher explicitly teaches all the method steps and the resulting structure and therefore, the structure can be considered a heat exchanger. Furthermore, the limitation of "to provide a heat exchanger" is a recitation of the intended use of the claimed invention and does not patentably distinguish the claimed invention from the prior art. If the prior art is capable of performing the intended use, then it meets the claim. Such is the case with the resulting ceramic body of Butcher.

In addition, Butcher teaches that there are 1600 channels in each square inch of cross section (col. 7, lines 6-10) of the body which translates to a channel cross section area $A=0.0002\ in^2$ and knowing that $A=\Pi \times r^2$ and with $\Pi=3.14$ and Diameter $D=2 \times r$ would result in the inner diameter of each channel to be about 0.028 inch which is within the claimed limitation of "no more than 2000 microns" or 0.079 in.

As applied to claim 27, Butcher teaches that the channels have inner diameters of between about 50 microns to about 2000 microns. Note that Butcher teaches channels inner diameters of 0.028 inch, which is equivalent to 711 microns.

As applied to claims 29 and 31, Butcher teaches that the curved channels made by removing circular (curved) cross section cores (22, Fig. 4) are arranged in the same direction.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1, 5-6, and 27-32 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Musso et al. (US 2003/0173720) in view of Butcher.

As applied to claim 1, Musso et al. teach a method for forming channeled articles used as heat sink for semiconductor devices comprising:

(a) simultaneously co-extruding one or more filaments including first composition (cores 36 & 38, Fig. 5) enclosed in a second composition body (14, Fig. 5);

(b) mechanically processing the filaments (cores 36 & 38, Fig. 5) to arrange them in a predetermined orientation to provide a green body (intermediate part 40, Fig, 5) and by depositing the filaments onto a working surface of in one or more layers (para. [0209], lines 1-3).

(c) subjecting the green body to conditions effective for removing the first composition (cores 36 & 38) from intermediate body (40) and sintering the second composition (body 14, para. [0041], lines 1-7) to provide a heat exchanger wherein channels (12, Fig. 1) having walls made of the sintered second composition for containing coolant flow with the channels having inner diameters of no more than about 2000 microns (para. [0110], lines 1-2, channels inner diameters of 0.013 inch is equivalent to 330 microns).

See Musso et al. (para. [0060], lines 1-8, para. [0061], line 3, and para. [0209], lines 1-3) for teachings of extruding filaments (core and body compositions).

Note that regardless of whether the first composition was initially extruded separately, the Examiner still considers that the already extruded first composition (cores 36 & 38) are indeed being simultaneously co-extruded again along with second composition (14).

In alternative, if applicant disagrees that Musso et al. teach the step of simultaneous co-extrusion of first and second compositions, Butcher teaches (Abstract, lines 1-24) that it is well known in the art to simultaneously co-extrude two compositions to form a two-component filament and mechanically processing the one or more filaments in a predetermined orientation to provide a green body and subjecting the resultant green body to conditions for removing the first composition and sintering the second composition to produce a more coherent and less fragile product with at least one but preferably a greater number of cells or channels per cross sectional area (Butcher, col. 1, lines 44-51).

It would have been obvious to one ordinary skill in the art at the time of invention to have provided Musso et al. with a simultaneous co-extrusion step as taught by Butcher in order to provide an effective and suitable means of fabricating a body with greater number of channels.

As applied to claim 5, Musso et al. teach that the first composition (core members) is thermally degradable composition and wherein the first composition is removed from the green body by heating it (para. [0219], lines 1-3).

As applied to claim 6, Musso et al. teach that the second composition (body 14) is metal and sinterable ceramics (para. [0090], lines 1-3 and Table 2).

As applied to claims 27 and 28, Musso et al. teach that the channels have inner diameters of between about 50 microns to about 100 microns. Note that Musso et al. teaches channels inner diameters of 0.013 inch, which is equivalent to 330 microns (para. [0110], lines 1-2) and channels inner diameters of as small as 0.0001 inch, which is equivalent to 2.54 Microns (para. [0199], lines 11-12).

As applied to claims 29-30, Musso et al. teach that the channels (12, Fig. 1) are arranged in the same direction and further filaments are arranged in two layers and at least two adjacent layers are arranged with the filament positioned to 90° to one another to provide a heat exchanger having multi-directional channels (Fig. 1, para. [0036], lines 8-11, channels 16 are all parallel to each other and channels 18 are all parallel to each other and at 90° or perpendicular to the channels 16).

As applied to claim 31, Musso et al. teach the channels 16 and 18 are circular in cross section and therefore curved (Fig. 1).

As applied to claim 32, Musso et al. teach input and output manifolds (82i, 82o, Fig. 6A) connecting respectively, to first and second walls of the heat exchanger.

6. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Musso et al. in view of Butcher as applied to claim 1 and further in view of Hoopman et al. (US 5,317,805).

Musso et al./Butcher teach the invention cited with the exception of exclusively disclosing the limitations of using a solvent to remove first composition. However, it is well known in the art to provide different methods for removing a core used to form a cavity in a ceramic matrix composite where the core is removed by heating, leaching and solvents amongst other methods. Furthermore, Hoopman et al. teach a method of making microchannel heat exchangers utilizing sacrificial cores wherein a core in a unitary microchannel heat exchanger's shell is made around a sacrificial core (102) with microchannel forming portions (108) that comprise filaments and further these filaments are removed by being dissolved in a solvent (col. 18, lines 13-18) resulting in fabrication of complex geometries of heat exchanger design to effectively meet the cooling demands of almost any shaped component or other medium requiring a specific heat exchanger geometry (col. 4, lines 28-33). It would have been obvious to one ordinary skill in the art at the time of invention to have provided Musso et al./Butcher with a suitable core composition such as one taught by Hoopman et al. in order to provide an effective and suitable means of fabrication for complex geometries of heat exchanger design.

7. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Musso et al. in view of Butcher and Hoopman et al. as applied to claim 3 and further in view of Davenport (US 3,222,144). Musso et al./Butcher modified by Hoopman et al. teach the invention cited with the exception of exclusively disclosing that the solvent used is water. It is well known in the art that the solvent used would depend on the chemical characteristics of the chemical targeted for removal, hence a water solvent is only indicative of the type of core material being used. Furthermore, Davenport teaches a manufacturing method of grid or honeycomb structures intended for use as heat exchangers (col. 6, lines 57-58) wherein a core (16) made of water soluble material can be dissolved in order to provide a self-supporting honeycomb structure within a shell or casing in a product in which the cellular passages are to be open (col. 4, lines 30-38, 45-48). It would have been obvious to one ordinary skill in the art at the time of invention to have further provided Musso et al./Butcher/Hoopman with a suitable solvent such as one taught by Davenport in order to provide an effective and suitable means of removing the core material resulting in fabrication of self-supporting honeycomb structure within a shell.

8. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Musso et al. in view of Butcher as applied to claim 6 and in further view of Hanaki et al. (US 4,746,479). Musso et al./Butcher teach the invention cited with the exception of exclusively disclosing the limitation of silicon carbide. However, Hanaki et al. disclose a

method of manufacturing a heat exchange element wherein the green body has a composition of silicon carbide used to form block type heat exchange elements which are heat resistive and have an improved property against thermal shock (col. 10, lines 32-38). It would have been obvious to one ordinary skill in the art at the time of invention to have provided Musso et al./Butcher with a suitable material such as one taught by Hanaki et al. in order to provide an effective and suitable material for a heat exchange element.

9. Claims 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Musso et al. in view of Butcher as applied to claim 1 and further in view of Avakian (US 2004/0106713).

As applied to claims 8-10, Musso et al./Butcher teach the invention cited with the exception of exclusively disclosing the use of a thermal conductivity enhancing material (claim 8), type of additive (claim 9) and weight percent (claim 10). However, Avakian teaches the use of additives in a thermoplastic compound wherein nanotubes of carbon is used as an example of thermal conductivity additive with a preferred range of 2 to 95 weight percent in order to enhance the existing manufacturing and use performance of the compound (Abstract, lines 1-12). It would have been obvious to one ordinary skill in the art at the time of invention to have modified Musso et al./Butcher with a suitable type and amount of additive material such as ones taught by Avakian to provide an effective means of further increasing the thermal conductivity of the heat exchange element.

10. Claims 8 and 9 are alternatively rejected under 35 U.S.C. 103(a) as being unpatentable over Musso et al. in view of Butcher as applied to claim 1 and further in view of Ocher et al. (US 2003/0131476). Musso et al./Butcher teach the invention cited with the exception of exclusively disclosing the use of a thermal conductivity enhancing material (claim 8) and type of additive (claim 9) used. However, Ocher et al. disclose a heat-dissipating element wherein certain materials are adequately used in making radiator structures (101, Fig. 17), heat conduits (115, Fig. 17) and heat reservoir (125, Fig. 17) for their high thermal conductivity characteristics such as silicon carbide (para. [0077], lines 1-10). It would have been obvious to one ordinary skill in the art at the time of invention to have modified Musso et al./Butcher with a suitable material such as one taught by Ocher et al. to provide an effective means of further increasing the thermal conductivity of the heat exchange element (col. 10, lines 43-51).

11. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Musso et al. in view of Butcher as applied to claim 1 and further in view of Rainer et al. (US 5,533,258). Musso et al./Butcher teach the invention cited with the exception of exclusively disclosing the limitations of depositing a thin layer of material (claim 11) and CVD process (claim 12). However, Rainer et al. teach a process for the manufacturing a cooling unit wherein a coating of an intermediate thin layer with a thickness range of 10 to 50 μm is deposited by CVD (chemical vapor deposition) process is used to provide an excellent joint between the parts made of heat resistant material and the metallic coolant conduit (col. 2, lines 25-30). It would have been

obvious to one ordinary skill in the art at the time of invention to have provided Musso et al./Butcher with deposition of a thin layer of material such as one taught by Rainer et al. to provide an effective means of part connection that would be capable of withstanding the high thermal stresses occurring during operation without the development of any significant damaging material cracks (col. 1, lines 60-67).

12. Claims 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Musso et al. in view of Butcher as applied to claim 1 and further in view of Rossi (US 2002/0037142). Musso et al./Butcher teach the invention cited with the exception of exclusively disclosing depositing a metallic layer. However, Rossi teaches a high thermal conductivity structure with a heat sink wherein the outer surface of the heat sink (18, Fig. 4) is nickel plated to provide improve weldability (para. [0060], lines 7-9). It would have been obvious to one ordinary skill in the art at the time of invention to have modified Musso et al./Butcher with a suitable metallic layer such as one taught by Rossi to provide an effective means of improved welding.

13. Claims 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Musso et al. in view of Butcher as applied to claim 1 and further in view of McCullough (US 6,093,961). Musso et al./Butcher teach the invention cited with the exception of exclusively disclosing the external protrusions. However, McCullough teaches a molded heat sink assembly wherein external protrusions (heat dissipating members (18), Fig. 2) is integrally formed to the base member (12, Fig. 2) and pointing upwardly

into the air for optimum heat exchange from the base member (12, col. 4, lines 28-30). It would have been obvious to one ordinary skill in the art at the time of invention to have modified Musso et al./Butcher by forming suitable external protrusions such as ones taught by McCullough to provide an effective heat dissipating means.

Response to Arguments

14. Applicant's arguments filed on 4/4/2007 have been fully considered but they are not persuasive.

15. Note that Applicant has amended previously presented claim 1 with the limitation of previously presented and now cancelled claim 2. Therefore, all the dependent claims presented in this amendment (original, previously and new) are all dependent on the newly amended claim 1 including the limitation of "depositing the filaments onto a working surface in one or more layers". Note that cancelled claim 2 was previously rejected as anticipated by both Butcher and Musso et al.

16. Applicant argues, see "Remarks", pages 1 and 2, with respect to the rejection of claims 1,2, 5-6, and 27-31 under 35 USC 102(b) as anticipated by Butcher that Butcher does not disclose "mechanically processing the one or more filaments to arrange the one or more filaments in a predetermined orientation to provide a green body by depositing the filaments onto a working surface in one or more layers" and that only

disclose firing of a single extruded strand to produce a composite body." And further argues (Remarks, page 1, item (3)) that Butcher discloses:

"Re-packing a number of multi-core strands into the extrusion barrel and re-extruding to form a strand with an even larger number of cores (See Col. 5, Lines. 54-64)."

The Examiner considers the repacking of a number of multi-core strands into an extrusion barrel as recited by the Applicant, to meet the limitation of mechanically processing and depositing the filaments onto a working surface (extrusion barrel) in one or more layers (layers of multiple strands).

As for Applicant's argument that Butcher does not disclose a heat exchanger, the examiner submits, as outlined in the action mailed on 1/4/2007, that Butcher explicitly teaches all the method steps and the resulting structure and therefore, the structure can be considered a heat exchanger. Furthermore, the limitation of "to provide a heat exchanger" even as recited in the preamble as "A method of manufacturing a heat exchanger comprising . . . " is still considered a recitation of the intended use of the claimed invention and does not patentably distinguish the claimed invention from the prior art. If the prior art is capable of performing the intended use, then it meets the claim. Such is the case with the resulting ceramic body of Butcher, which is considered a heat exchanger.

17. Applicant argues further, see "Remarks", pages 2 and 3, with respect to the rejection of claims 1,2, 5-6, and 27-31 under 35 USC 102(e) as anticipated by Musso et al. that Musso et al. do not disclose the following:

"mechanically processing the one or more filaments to arrange the one or more filaments in a predetermined orientation to provide a green body by depositing the filaments onto a working surface in one or more layers";

"second (i.e. matrix) material being extruded";

"no two-component filaments are produced"; and

"arranging two-component extruded filaments into a body and depositing such filaments onto a working space."

The Examiner respectfully disagrees with the above arguments. As outlined in the office action mailed on 5/16/2006, the Examiner considers that Musso et al. teaching of an extrudable composition used as a core composition (paragraph [0209], lines 1-3) and placing it in a die and extruding a body composition around it, clearly teach the limitation of simultaneous extruding of (two composition) the core and body compositions and that the filaments (cores 36 & 38) are mechanically arranged in a predetermined orientation to be extruded and depositing the filaments onto a working surface in one or more layers.

The Examiner considers any surface that the filaments are placed on is considered a working surface and as such, both Butcher and Musso et al. teach that limitation.

18. Applicant argues, see "Remarks", pages 3 and 4, with respect to the rejection of claims 1,2, 5-6, and 27-31 under 35 USC 103 (a) over Musso et al. in view of Butcher that they "are not properly combinable or modifiable as proposed by the Examiner to form an obvious rejection" based on two main assertions that Musso et al. methods are

not compatible with the extrusion methods described in Butcher and that Butcher teaches away from arranging the cored strands to form a green body."

Once again the Examiner respectfully disagrees with the above arguments and contends that the rejections based on Musso et al. in view of Butcher are only in alternative, in case the Applicant disagrees with Musso et al. teaching of the simultaneous co-extrusion of first and second compositions. Therefore, Butcher was only relied upon to teach that it is well-known to simultaneously co-extrude two compositions to form a two-component filament and mechanically processing the filaments to provide a green body and subjecting the green body to remove first composition and sintering the second composition in order to produce a more coherent and less fragile product with a great number of channels formed.

19. Applicant argues further, see "Remarks", page 5, with respect to the rejection of other claims (claims 3-14 and 27-31) over Musso et al. in view of Butcher, Hoopman, Davenport, Hanaki, Avakian, Ocher, Rainer, Rossi, and McCullough, that none teach, or suggest the method of manufacturing as claimed and do not cure the deficiencies of Musso et al. and Butcher.

The Examiner respectfully disagrees with the above arguments and contends that both Musso et al. and Butcher, as previously discussed above, teach the claimed invention and other references are only relied upon to teach the deficiencies of Musso et al. and Butcher.

Conclusion

20. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sarang Afzali whose telephone number is 571-272-8412. The examiner can normally be reached on 7:00-3:30 M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Bryant can be reached on 571-272-4526. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

SA
6/12/2007

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6/13/07